

A presentation on turf runway design that was given at the 1997 Central Region Airports Conference

TURF RUNWAYS

A while back after taking a day off from work, I came into the office. My boss asked me how my day was and did I know that I volunteered to speak at the Iowa Aviation Conference. I told him that sounded great, “What was my topic?” He said I was to speak on the design of turf runways. Well, I thought that's a pretty good topic, so I went back to desk and started to do a little research.

The first place I looked was our Bible, Advisory Circular 5300-13, Airport Design. Everything you ever wanted to know about airport design is in that AC. Does anybody know how many references in 5300-13 there are for turf runways. Well, there isn't any.

Does that mean there isn't any design criteria?

A little history lesson is needed. In the early years of aviation, all airplanes operated from relatively unimproved airfields. As aviation developed, the alignment of takeoff and landing paths centered on a well defined area known as landing strip.

The requirements of more advanced aircraft necessitated improving or paving the center portion of the landing strip. The term landing strip was retained to describe the graded area surrounding and upon which the runway or improved surface was constructed.

The primary role of the landing strip was retained to describe the graded area surrounding the runway. The area had to be capable of, under normal conditions, of supporting airplanes without causing structural damage to the aircraft or injury to its occupants.

Later the designation of this area was changed to "runway safety area" to reflect its functional role. So in essence, we can speak of turf or unpaved runways, runway safety areas and landing strips in the same manner.

Let's take a look at the design standards set forth in AC 5300-13.

UNPAVED (TURF) RUNWAY DESIGN STANDARDS

SOURCE: AC 150/5300-13 CHANGES 1 THRU 5

Aircraft Category

A grouping of aircraft based on 1.3 times their stall speed in their landing configurations at their maximum certificated landing weight.

Category A: Speed less than 91 knots

Category B: Speed 91 knots or more but less than 121 knots

Category C: Speed 121 knots or more but less than 141 knots

Category D: Speed 141 knots or more but less than 166 knots

Category E: Speed 166 knots or more

Airplane Design Group (ADG)

A grouping of aircraft based on wingspan. The categories are as follows:

Group I: Up to but not including 49 feet.

Group II: 49 feet up to but not including 79 feet.

Group III: 79 feet up to but not including 118 feet.

Group IV: 118 feet up to but not including 171 feet.

Group V: 171 feet up to but not including 214 feet.

Group VI: 214 feet up to but not including 262 feet.

Note: Small airplane is an airplane of 12,500 pounds or less maximum certified takeoff weight

Table 3-1, Runway Design Standards for Approach Category A & B Visual Runways

- **Runway length** is determined by the type of aircraft. Because runway safety areas and unpaved runways by definition are the same, the same length is used to describe both.
- Again, because runway safety areas and unpaved runways are the same by definition, **runway width** corresponds to the **runway safety area width**.
- Runway shoulder width, runway blast pad width and length do not apply to turf runways.
- **Obstacle free zone (OFZ)**. The length is the same as the length of the unpaved runway. Width is 400' for large airplanes. For small airplanes, width is 250' for airplanes with approach speeds of 50 knots or more and 120 feet for small airplanes with approach speeds of less than 50 knots.
- **Runway Object Free Area (ROFA)** width is as shown and runway object free area length is the same as the unpaved runway length. For aircraft approach category A and B, this dimension also defines the crop restriction line.

Table 2-4. Runway Protection Zone Dimensions

- **Runway Protection Zone (RPZ)** dimensions correspond to a visual approach.
- RPZ begins at the runway threshold and is trapezoidal in shape. It is 1000' long by 250' inner width by 450' outer width for small aircraft exclusively (<12,500 pounds) and 1000' long by 500' inner width by 700' outer width for aircraft category A & B with large aircraft.
- It is desirable to own the RPZ or have sufficient interest so that it can remain free of incompatible activities.

TURF RUNWAY GRADING CRITERIA CATEGORY A & B AIRCRAFT

SOURCE: AC 150/5300-13 CHANGE 1 THRU 5

FIGURE 5-2, Transverse grade limitations for aircraft approach categories A & B

- Maximum longitudinal grade is $\pm 5\%$.
- Maximum transverse grade is $\pm 5\%$.
- Grading should be done such that water will not pond and will flow away from the runway. Grading should be done so that water will also not pond on the taxiway so that access to the runway is not limited.

COMPACTION REQUIREMENTS

SOURCE: AC 150/5370-10A

- FAA Specification P-152, Excavation and Embankment
- Compaction requirements are dependent on soil type and wheel loading

FAR PART 77 SURFACES

- Establishes standards for determining obstructions to air navigation
- Primary surface ends at the end of the unpaved runway and the 20:1 approach surface begins.

DEFINITIONS

Runway

A defined rectangular surface on an airport prepared or suitable for the landing or takeoff of airplanes.

Runway Safety Area (RSA)

A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

Runway Object Free Area (ROFA)

An area centered on a runway provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the ROFA for air navigation or aircraft ground maneuvering purposes.

Runway Protection Zone (RPZ)

An area off the runway end to enhance the protection of people and property on the ground.

Obstacle Free Zone (OFZ)

The OFZ is the airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDS that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway, and for missed approaches.

As you can see, although it is not specifically spelled out in our Airport Design Standards, there are standards for turf runways.